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Risk factors for incident carpal tunnel syndrome: Results of a prospective cohort study of newly-hired workers

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Abstract

Carpal tunnel syndrome is one of the most costly upper extremity disorders in the working population. Past literature has shown an association between personal and work factors to a case definition of carpal tunnel syndrome but little is known about the combined effects of these factors with the development of this disorder. Few studies have examined these associations in longitudinal studies. The purpose of this paper is to identify risk factors for incident carpal tunnel syndrome in a longitudinal study of workers across a wide range of occupations.

Keywords

Carpal tunnel syndrome; risk factors; epidemiology

1. Introduction

Carpal tunnel syndrome (CTS) is the most common upper extremity peripheral neuropathy, and carpal tunnel release surgery is the most commonly performed surgery of the hand, with estimates of 200,000 to 500,000 procedures performed annually in the United States [1,2]. The prevalence ranges from 1%–5% among the general population, and up to 14.5% among specific occupational groups [3,4]. The incidence of CTS in general populations has varied from 1.8 per 1000 [5] to 2.8 per 1000 [6] in studies NCS to confirm the diagnosis. Higher incidence and prevalence have been reported in some working populations.

Despite great interest in CTS on the part of researchers and the public, a number of gaps in our knowledge limit potential prevention and treatment efforts. CTS is recognized as a multi-factorial disease with both personal and work-related risk factors, yet little is known about the interactions between physical, personal, and psychosocial factors, nor about the quantitative relationship between increasing physical exposures and increasing risk. The purpose of this paper is to identify risk factors for incident carpal tunnel syndrome in a longitudinal study of workers across a wide range of occupations.

2. Method

We enrolled 1107 newly employed workers from a variety of industries in a three year prospective study. At baseline each worker received a physical exam of the upper extremities and nerve conduction studies (NCS) of sensory and motor conduction in the

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bilateral median and ulnar nerves. Workers also completed a questionnaire that included hand symptoms, job title, self-reported work exposures, personal health, and psychosocial factors. Questionnaires were repeated at 6, 18, and 36 months; physical exam and NCS were repeated at 36 months. We used two case definitions of CTS: the first required the presence of symptoms of numbness, tingling, burning, or pain in at least two digits in the median nerve distribution AND abnormal NCS. The second case definition required only abnormal NCS, defined as median distal sensory latency greater than 3.5 milliseconds or distal motor latency greater than 4.5 milliseconds or medianulnar sensory latency difference greater than 0.5 milliseconds. Incident (new) cases were those who met a case definition at 3 year follow-up but not at baseline examination.

Work-related exposures were estimated by self-report and by job title. Workers reported average daily time for 7 physical exposures using a modified Nordstrom questionnaire: hand/wrist bending, forearm rotation, pinch grip, use of hand-held vibrating power tools, finger/thumb pushing/pressing, forceful grip, and lifting >1 kg. Based on job titles, 13 exposure variables were extracted from O*NET, a publicly available database developed by the U.S. Department of Labor, using variables related to hand strength, dexterity and speed and repetitive movements. We ran separate analyses using these self-reported exposures and job-title based exposures.

Logistic regression models used the most recent exposure preceding the repeat nerve conduction testing and report of symptoms. Subjects that met the case definitions at baseline were eliminated from the analysis. Clinical covariates were body mass index (BMI), age, and gender. A single self-reported physical exposure or job-title based exposure was added to each model.

3. Results

Of 1107 workers enrolled at baseline, repeat nerve conduction studies and questionnaire were available on 745 (67%) at 3 year follow-up. In the first case definition of CTS (symptoms AND abnormal NCS), 723 subjects were eligible for the incident analysis and 29 (4%) met the case definition (22 had positive findings at baseline). In the second case definition (abnormal NCS) of 549 subjects with normal baseline NCS, 55 (10%) had abnormal NCS at follow-up (196 had abnormal NCS at baseline).

In logistic regression models adjusted for age, gender, and body mass index (BMI), preliminary analyses showed that two self-reported physical exposures were statistically significantly associated with incident CTS (symptoms AND abnormal NCS), including forceful gripping (Odds ratio of 2.59; 95% Confidence interval of 1.12–5.99) and lifting > 1kg (Odds ratios of 3.27; 95% Confidence interval of 1.27–8.44). In logistic regression models with incident abnormal NCS as the outcome, the self-reported exposure of time spent using hand-held vibrating power tools was significant (Odds ratio of 2.02; 95% Confidence interval of 1.04–3.90).

In models using job-title based estimates of exposure, factor analysis combined the 13 O*NET variables into three factors, corresponding to force, repetition, and vibration. When these three factors were entered separately into logistic regression models that also included age, gender, and BMI, the force variable was significantly associated with incident abnormal NCS (Odds ratio of 1.45; 95% Confidence interval of 1.06–1.99).

4. Discussion

We examined new cases of abnormal NCS and those meeting a case definition of CTS in a 3-year follow-up of newly-hired workers. These outcomes of CTS were associated with workplace physical exposures in this prospective cohort study. This cohort continues to be followed for work exposures and will receive additional follow-up testing with nerve conduction testing and questionnaires. Future analyses will explore the associations of work exposures with self-reported symptoms, NCS, and the combination of symptoms and abnormal NCS case definitions.

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